REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	04/07/77	

4. TITLE AND SUBTITLE
DETERMINATION OF DECONTAMINATION CRITERIA, DIMP AND DCPD (U)

5. FUNDING NUMBERS
DAMD 17 C 5069

6. AUTHOR(S)
O'DONOVAN, P.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
AEROJET ORDNANCE & MANUFACTURING COMPANY
DOWNEY, CA

8. PERFORMING ORGANIZATION REPORT NUMBER
81320R20

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
FORT DETRICK (FREDERICK, MD.)
FORT DETRICK, FREDERICK, MD

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
THIS IS A PROGRESS REPORT ON AEROJET'S STUDIES OF EXPERIMENTS CURRENTLY UNDERWAY (E.G., PLANT GROWTH & DIMP & DCPD LYSIMETER TESTS). TWO SETS OF LYSIMETERS HAVE BEEN UTILIZED IN A SERIES OF EXPERIMENTS DESIGNED TO STUDY THE MOBILITY OF DIMP IN VARIOUS TYPES OF SOIL. THE DRAINAGE SAMPLES FROM THE GROUP 2 LYSIMETERS HAVE BEEN TERMINATED. ANALYSIS OF THE 1, 8 AND 20 PPM DIMP EXPOSED PLANTS FROM THE SOIL GROWTH TESTS IS PARTIALLY COMPLETE.

14. SUBJECT TERMS
LYSIMETER, CONTAMINANTS, FLORA, SOIL, CHEMICALS

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

81320R20

ORIGINAL

AEROJET ORDNANCE AND MANUFACTURING COMPANY
9236 East Hall Road
Downey, California 90241

DETERMINATION OF DECONTAMINATION CRITERIA

DIMP AND DCPD (U)

Report No. 1953-01(20)MP

Contract DAMD-17-C-5069

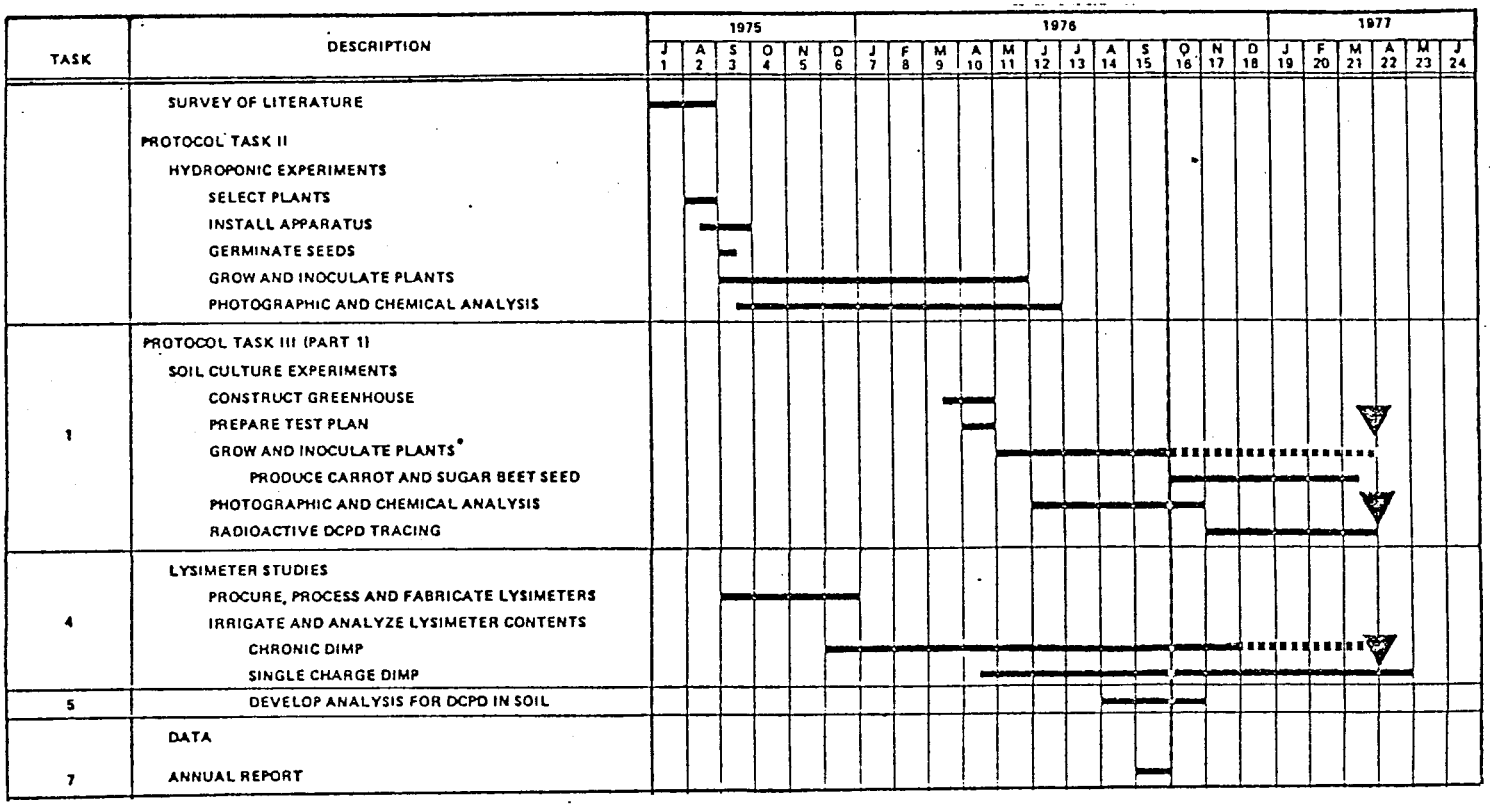
To

U. S. Army
Ft. Detrick
Fredrick, Maryland 21701

Prepared by: P. A. O'Donovan
P. A. O'Donovan

Date: 7 April 1977

No. of Pages: 15



▼ - Satisfactory Progress - on schedule

Determination of Decontamination Criteria - DIMP and DCPD
Research Task Schedule

Progress on items proposed for action during March 1977, is discussed in this report.

Full Scale Lysimeter Tests

Two sets of lysimeters have been utilized in a series of experiments designed to study the mobility of DIMP (diisopropyl methyl phosphonate) in various types of soil. The five types of soil used and their source locations are:

Chino	-	sandy clay loam
Brawley	-	silty clay
Ventura	-	clay loam
Fullerton	-	sandy loam
Walnut	-	clay loam

These soils were dried, screened and repacked into five foot deep steel cylinders, epoxy coated on the inside and fitted at various depths with porous ceramic tensiometers for sampling the ground water. Group 1 was a series of five lysimeters chronically exposed to irrigation with 20 ppm DIMP in distilled water. This series was terminated last month. Group 2 was another series of 5 lysimeters in which the top 1 foot depth of soil was intimately mixed with DIMP to a concentration of 20 ppm and regular additions of 2 inches (12,887 ml) of distilled water were added to the surface and allowed to percolate down through the soil. This percolating water as well as the soil itself was sampled at various depths to follow the progress of the DIMP through the soil.

Table 1 shows data from two of the final four core samples from the group 1 lysimeters. There is some variation between sample 1 and sample 2. These will be combined with data from the other terminal core samples as it becomes available.

Table 1

DIMP Content of Soil Samples (ppm) 426 Days

Group 1

Depth	Ventura	Chino	Fullerton	Walnut	Brawley
	(1) (2)	(1) (2)	(1) (2)	(1) (2)	(1) (2)
0 (surface)	22.0 - 22.4	38.3 - 27.4	21.3 - 23.7	49.0 - 26.2	14.8 - 8.6
0 - 6"	5.7 - 3.1	8.5 - 7.4	6.8 - 3.9	16.2 - 6.2	* - 5.9
6 - 12"	3.8 - 3.0	6.4 - 7.1	6.8 - 3.9	6.9 - 5.2	* - 5.6
12 - 18"	1.5 - 1.5	5.5 - 6.1	6.3 - 3.1	6.2 - 3.8	6.9 - 6.4
18 - 24"	3.2 - 2.1	4.6 - 3.8	4.0 - 3.1	4.5 - 3.8	4.5 - 8.0
24 - 30"	1.4 - 2.6	3.4 - 6.4	4.4 - 3.3	5.4 - 5.1	6.4 - 6.8
30 - 36"	0.8 - 2.2	3.0 - 1.2	6.2 - 2.9	5.5 - 5.1	6.2 - 4.8
36 - 42"	1.6 - 2.3	4.9 - 1.7	6.0 - 2.0	6.7 - 4.1	5.0 - 5.2
42 - 48"	1.7 - 2.6	2.6 - 1.6	5.1 - 2.4	5.5 - 4.4	5.7 - 3.7
48 - 54"	1.7 - 2.3	2.6 - 2.0	3.1 - 3.4	5.2 - 4.2	4.3 - 4.2
54 - 60"	2.0 - 3.7	* - 10.6	5.1 - 2.5	4.1 - 7.4	4.3 - 4.2

* 0.1 ppm

The drainage samples from the group 2 lysimeters have been terminated also. The final samples were taken at 322 days. The drainage ratios (volume of water recovered divided by the volume of water added) of all the group 2 samples have been plotted up to date on Figures 1 and 2. The data from the soil core samples of group 2 at 322 days is shown in Table 2. The tensiometer water samples taken at 315 days gave the results shown in Table 3.

Multiple soil core samples, four series from each lysimeter in both group 1 and group 2, have been taken and are being analyzed. The purpose of the multiple sampling is to diminish the horizontal inhomogeneities in the final set of data.

The average drainage ratios of the group 2 lysimeters over the entire test period are shown in Table 4.

Table 4

Average of Drainage Ratios After 322 Days

Group 2

Soil Desig.	Soil Type	Avg. Drainage Ratio
Chino	Sandy Clay Loam	0.20
Brawley	Silty Clay	0.17
Ventura	Clay Loam	0.28
Fullerton	Sandy Loam	0.36
Walnut	Clay Loam	0.40

Mean = 0.28

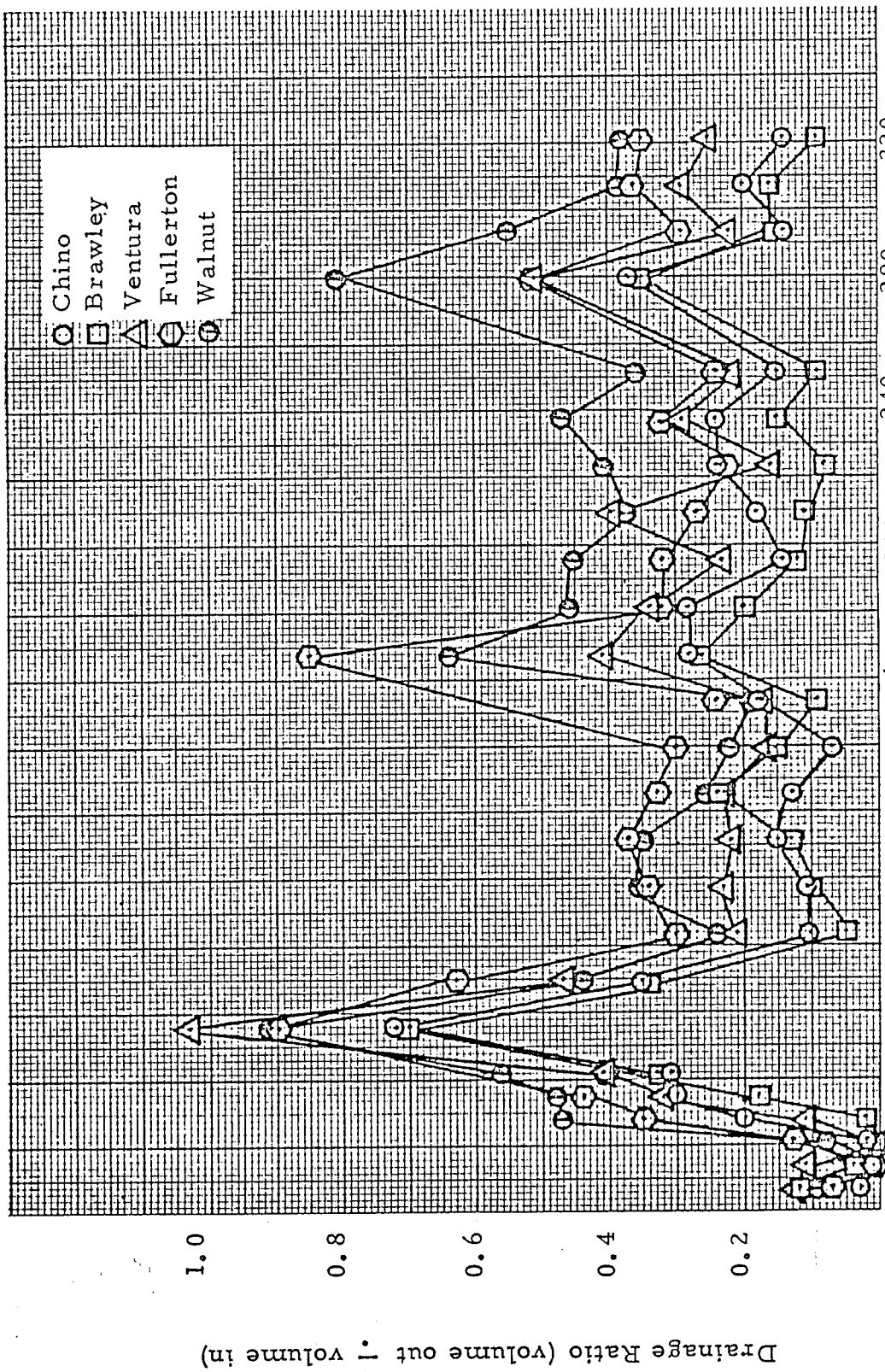


Figure 1. Drainage Ratios of Various Soils in Full Scale Lysimeters

Group 2

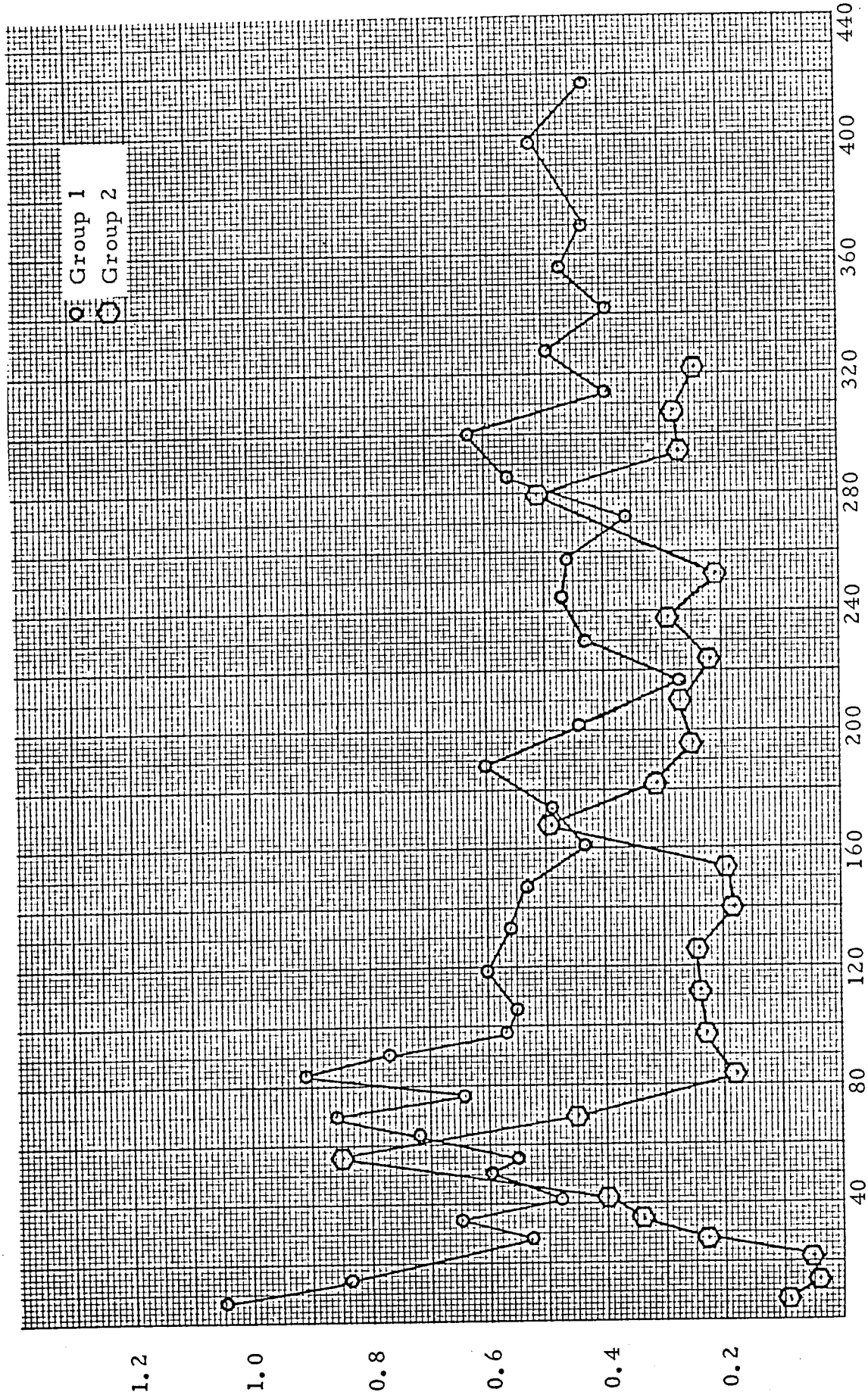


Figure 2. Drainage Ratios of Various Soils in Full Scale Lysimeters

Average of All Samples Within the Groups

Table 2

DIMP Content of Soil Samples (ppm) (322 Days)

Group 2

Depth	Ventura	Chino	Fullerton	Walnut	Brawley
0 (surface)	*	*	*	*	*
0 - 6	*	*	*	*	*
6 - 12"	*	*	*	*	*
12 - 18"	*	*	*	*	*
18 - 24"	*	*	*	*	*
24 - 30"	0.6	2.9	*	*	6.5
30 - 36"	1.7	4.8	*	*	24.1
36 - 42"	3.4	6.2	5.0	*	14.8
42 - 48"	6.6	9.1	12.7	0.8	6.7
48 - 54"	14.5	5.0	10.3	4.1	1.1
54 - 60"	12.3	2.3	6.3	6.2	*

Table 3

DIMP Content of Tensiometer Water Samples (ppm) (315 Days)

Group 2

Depth	Ventura	Chino	Fullerton	Walnut	Brawley
6"	*	*	*	*	*
18"	*	13.0	*	*	2.9
30"	9.3	46.2	21.8	12.2	58.6
42"	72.2	**	33.7	15.9	18.2
54"	39.5	24.6	31.1	61.5	*
60"	*	2.2	45.4	*	*

* .0.1 ppm

** No sample

These averages are somewhat lower than similar averages for the group 1 samples. One possible reason for this is that the group 2 lysimeters were in a relatively less protected area than the group 1 units which could have resulted in a greater evaporation rate of the standing water.

Soil Culture Experiments

Analyses of the 1, 8 and 20 ppm DIMP exposed plants from the soil growth tests is partially complete. Results from some of the analyses are shown in Tables 5a, 5b and 5c. As noted in previously analyzed species the soil grown plants, in general, show much less bioconcentration than do the hydroponically grown samples possibly due in great part to the hindered mobility of the test compounds. Figures 3, 4 and 5 show this data graphically.

Harvesting of the broad range (50-1000 ppm) soil growth tests is essentially complete. Yield data from these plants is currently being determined.

Table 5 (a)

Bioconcentration of DIMP by Plant Parts (Terminal)
in
20 ppm Irrigation

Plant Part	Total DIMP Added to Pot		Days From Orig. Inoc	DIMP Conc. in Tissue (ppm)	Bioconcentration Factor
	Vol. of 20 ppm Irr. (cc)	Wt. of DIMP (mg)			
Sugar Beet	49,300	986	196		
Root				11	0.6
Stem				-	-
Leaf				65	3.3
Carrot	52,700	1054	225		
Root				13	0.7
Stem				27	1.4
Leaf				69	3.5
Bean	17,100	342	65		
Root				81	4.1
Stem				63	3.2
Leaf				121	6.0
Wheat	17,100	342	65		
Root				22	1.1
Stem				10	0.5
Leaf				106	5.3
Alfalfa	23,400	468	115		
Root				5	0.3
Stem				*	-
Leaf				24	1.2

* None detected
\- No sample

Table 5 (b)

Bioconcentration of DIMP by Plant Parts (Terminal)
in
8 ppm Irrigation

Plant Part	Total DIMP Added to Pot		Days From Orig. Inoc	DIMP Conc. in Tissue (ppm)	Bioconcentration Factor
	Vol. of 20 ppm Irr. (cc)	Wt. of DIMP (mg)			
Sugar Beet	49,300	394	196		
Root				5	0.6
Stem				-	-
Leaf				24	3.0
Carrot	52,700	422	225		
Root				1	0.3
Stem				5	0.6
Leaf				17	2.1
Bean	17,100	137			
Root				46	5.8
Stem				29	3.6
Leaf				41	5.2
Wheat	17,100	137			
Root				*	-
Stem				*	-
Leaf				86	10.7
Alfalfa	23,400	184	115		
Root				11	1.4
Stem				6	0.8
Leaf				21	2.6

* <0.1 ppm

Table 5 (c)

Bioconcentration of DIMP by Plant Parts (Terminal)
in
1 ppm Irrigation

Plant Part	Total DIMP Added to Pot: Vol. of 20 ppm Irr. (cc)	Total DIMP Added to Pot: Wt. of DIMP (mg)	Days From Orig. Inoc	DIMP Conc. in Tissue (ppm)	Bioconcentration Factor
Sugar Beet	49,300	49	196		
Root				*	-
Stem				-	-
Leaf				1	1
Carrot	52,700	53	225		
Root				1	1
Stem				1	1
Leaf				10	10
Bean	17,000	17			
Root				9	9
Stem				1	1
Leaf				3	3
Wheat	17,100	17			
Root				4	4
Stem				4	4
Leaf				*	-
Alfalfa	23,400	23	115		
Root				*	-
Stem				*	-
Leaf				*	-

* < 0.1 ppm

\- No sample

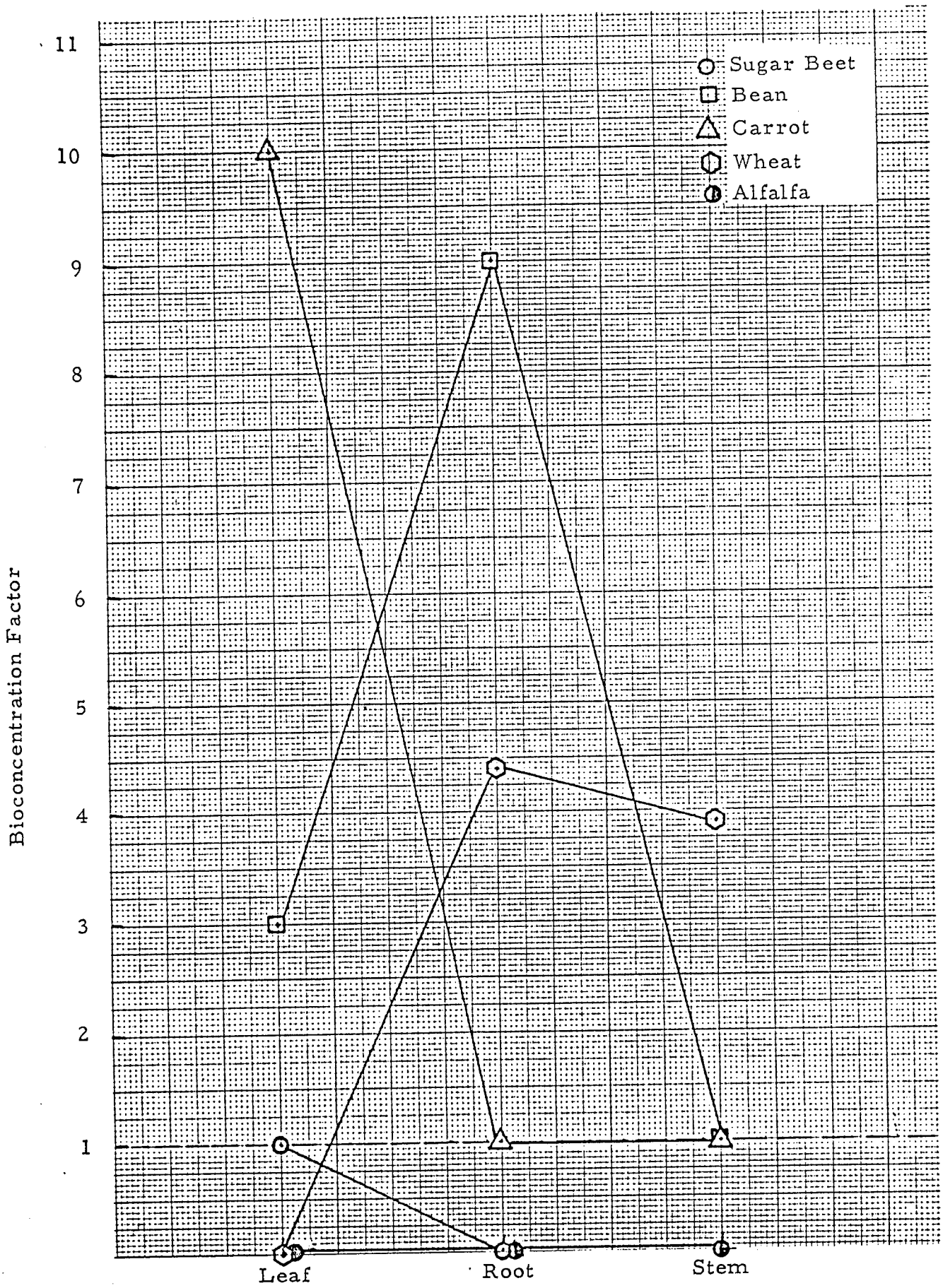


Figure 3. Bioconcentration of DIMP by Plant Parts.
Soil Culture, Exposure to 1 ppm DIMP in Irrigation Water

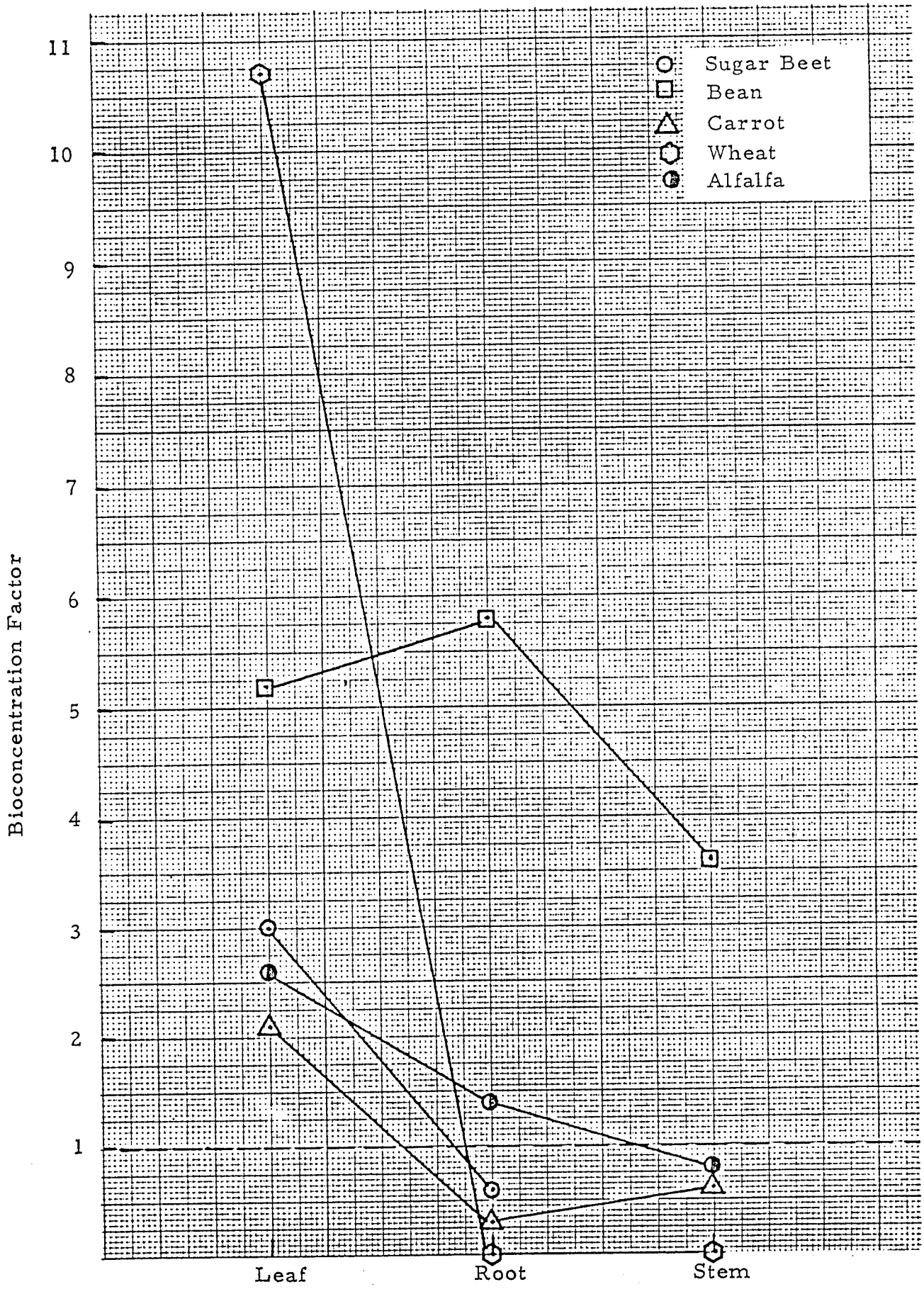


Figure 4. Bioconcentration of DIMP by Plant Parts.
Soil Culture, Exposure to 8 ppm DIMP in Irrigation Water

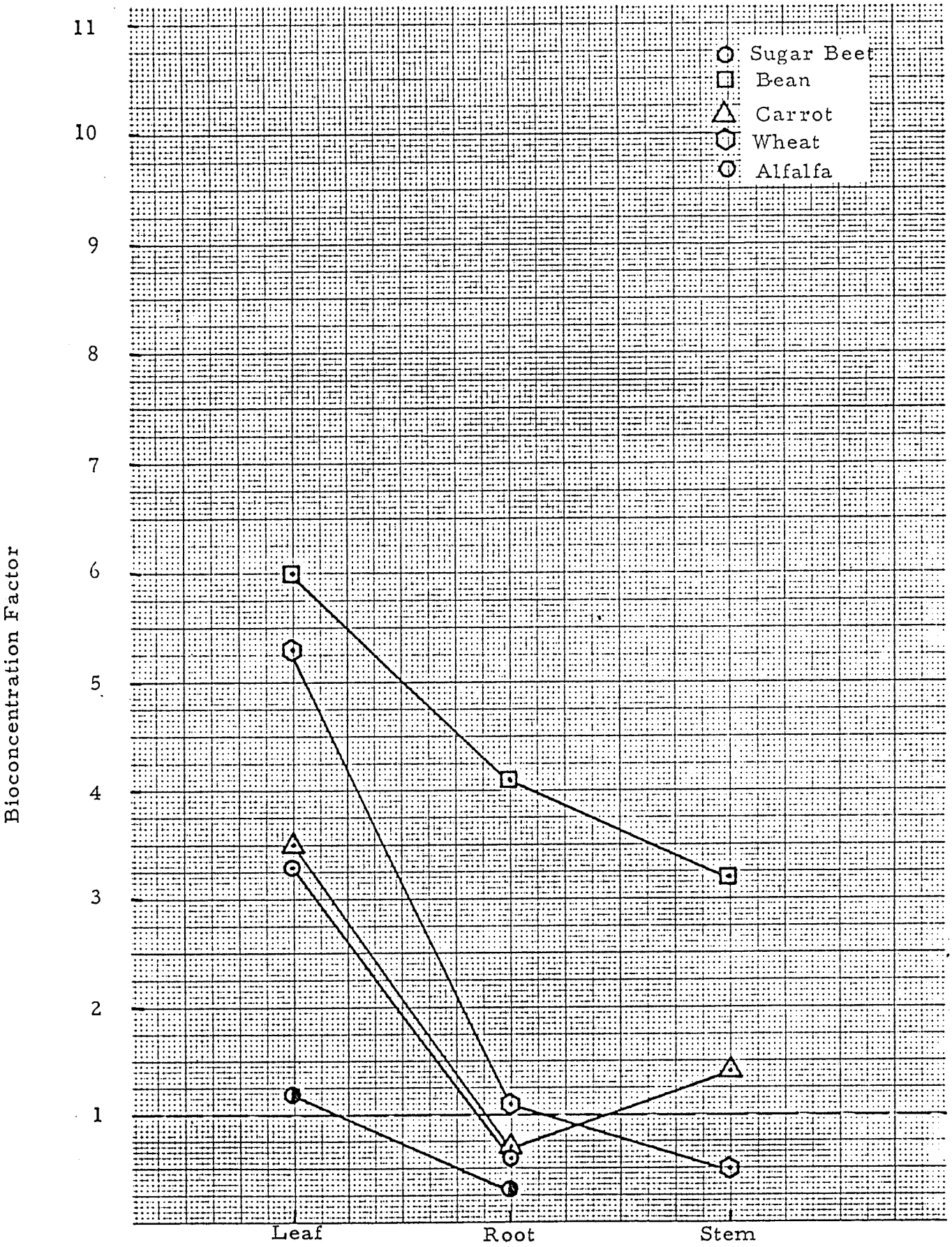


Figure 5. Bioconcentration of DIMP by Plant Parts.
Soil Culture, Exposure to 20 ppm DIMP in Irrigation Water.

PROPOSED ACTIVITY FOR APRIL 1977

- Harvest and weigh plants from the range finding soil growth experiments to determine effective dose levels of contaminants.

- Continue radioactive DIMP and DCPD in soil evaporation/ decomposition experiments.

- Continue ancillary analyses on soil and tissues from growth tests terminated in December.

- Analyze group 1 and group 2 multiple terminal lysimeter samples.